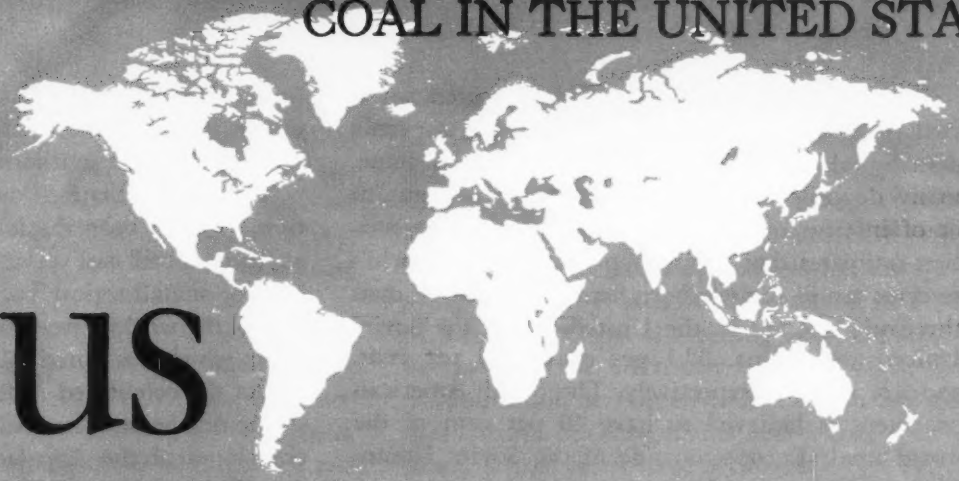
COAL IN THE UNITED STATES



focus

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Outlook for Coal in the United States

As the world swings into an era characterized by earth satellites, space probings, automation, a rapidly increasing population and rising per capita consumption, new and greater demands are being made upon our mineral resources, and appraisal of them becomes ever more urgent. We shall try here to examine briefly the outlook for coal as an energy source in the United States and its role in meeting the requirements of the future.

More coal has been mined and consumed during the last three decades than in all preceding history. The continued availability of this primary source of energy is of utmost economic and political importance to all industrial nations, for there are few manufactured goods in modern civilizations that do not owe their existence, directly or indirectly, to it. Coal has made possible the smelting of iron and the making of steel tools and machines. It is the prime energy source used for electricity and heat.

Coal first appeared on the industrial scene when English blacksmiths began using it for heating the iron in their "smithies." Owners of small shops came to like it better than wood because of its more intense and uniform heat. Coal plus Watt's invention of the steam engine sparked the Industrial Revolution of the nineteenth century, which permitted man to escape from his immemorial dependence upon human muscle and work animals.

The total energy needs of the United States in 1850 were equivalent to about 20 million tons of coal. Less than one-third of this actually came from coal; the rest came from wood and waterpower. Between 1850 and 1900, the annual per capita energy requirements increased only slightly, but the growth of industry together with the tripling of the population skyrocketed the demand for energy, more and more of which had to be obtained from the irreplacable mineral fuels.

In the twentieth century the continued population growth, the electrification of the country, and the advent of the auto were responsible for striking changes and increases in our energy requirements. Larger markets for electricity, along with higher costs of coal and remarkable technical progress led to a huge decrease in the amount of coal needed to produce a kilowatt-hour: from seven pounds in 1900 to 0.91 pounds in 1958. The auto brought widespread use of petroleum products. It is an interesting fact that per capita consumption of coal is just about what it was 59 years ago, yet per capita consumption of energy has quadrupled during this period; most of this extra energy has been in the form of petroleum, the use of which has grown by six per cent a year since World War I.

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THE FORTUNATE FEW. The estimated world coal reserves of 5.2 trillion tons are very unevenly distributed. Although every continent has some, many deposits are either insignificant in amount or of inferior quality. The National Coal Association estimates that about 97 per cent of the world's reserves are in the northern hemisphere. More than three-quarters are in the United States, the Soviet Union, and China, 38.1 per cent, 33.6 per cent, and 9.5 per cent respectively. The North American continent is believed to have 40 per cent of the world total; Europe, outside of the Soviet Union, 12.5 per cent.

Present surveys, many of a reconnaissance nature, indicate that Central and South America and much of Africa lack large reserves. Further geological investigation may reveal greater ones, but adequate and cheap modes of transportation still would have to be created to make them easily exploitable.

The Department of the Interior, in a special study made in 1956 for the Panel on Peaceful Uses of Atomic Energy, stated that United States coal reserves total 1.9 trillion tons. It further estimates that half of this coal, or 948 billion tons, is economically recoverable, of which 237 billion tons could be mined at or near present costs. If coal production continues to run in the neighborhood of 500 million tons a year, there should be enough coal for almost 500 years at or near present production costs. Another 285 billion tons could be mined at one-and-one-quarter to one-and-one-half present costs, and still another 426 billion at one-and-one-half to four times these costs.

TOP PRODUCERS. The average American disposes of an energy equivalent of nine tons of coal annually. His European cousin has less than three tons, and the average Asian only about one-twentieth of a ton. Millions in the so-called underdeveloped lands of the southern hemisphere use even less.

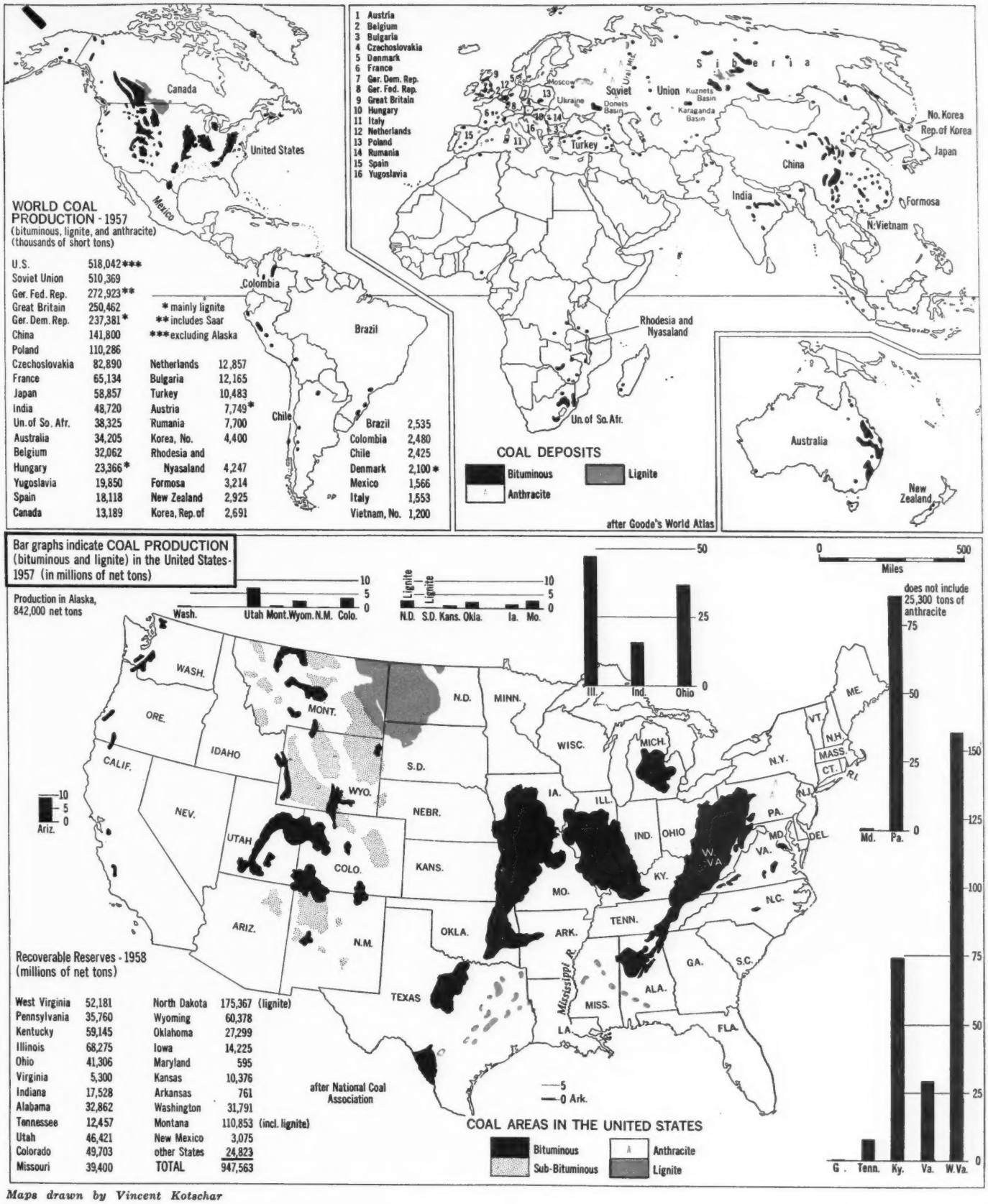
	Estimated Remaining Coal Reserves (billion short tons)	Percentage of World Total
United States	2,002.5	38.1
Soviet Union	1,763.2	33.6
China	495.9	9.5
Germany	315.2	6.0
Great Britain	187.3	3.6
Canada	98.4	1.9
Poland	88.0	1.7
India	66.1	1.3
Australia	64.5	1.2
Union of South Africa	61.0	1.2
Czechoslovakia	19.0	0.4
Colombia	13.8	0.3
France	12.3	0.2
Japan	10.9	0.2
Chile	0.8	—

The United States, world leader in industrialization, has also been the leader in coal production—at least, until last year. Large reserves of high-quality metallurgical coal make the Appalachian region the world's greatest source of industrial coal, a fact which has contributed in no small way to the rise of the celebrated American manufacturing belt in the northeast. The coal region includes the western slopes of the Appalachian Mountains and the Appalachian Plateau in Pennsylvania, West Virginia, Ohio, Kentucky, Tennessee, Alabama, and Virginia.

About 70 per cent of the yearly national output of some 518 million tons is mined in this area. About 94 per cent is mined east of the Mississippi River. However, this ratio between east and west will undoubtedly change in the not-too-distant future. In the extensively mined Appalachian fields it is becoming increasingly difficult to find thick beds of a high quality. This is especially true of bituminous coals, with optimum coking properties and low sulfur content, which are used for metallurgical coke. Recently, several large steel companies, recognizing that their supply may be close to exhaustion within a decade or two, have made long-term contracts with outside coal companies having big reserves.

Other vast deposits lie in the eastern interior field of Illinois-Indiana-western Kentucky, and the western interior field of Iowa-Missouri-Kansas-Oklahoma. Farther west, more large deposits, which are increasing in value with the westward expansion of population and industry, are scattered throughout such states as North Dakota, Montana, Wyoming, Colorado, and Utah. Although they currently produce only six per cent of the nation's coal, the seven major coal states west of the Mississippi have 68 per cent of the reserves.

Reports indicate that in 1958 the Soviet Union outranked the United States in coal production for the first time in history. Several new fields have been developed. The biggest producing field is the Donets Basin, in eastern Ukraine. The second is the Kuznets Basin, in western Siberia. The Kuznets probably contains the largest reserves of industrial coal in the Union, but distances to leading industrial markets are great. Other major producing



Maps drawn by Vincent Kotschar

centers are located in the Ural Mountains, the Moscow area, and the Karaganda Basin. The recent enormous increase in production has been in response to a rapid expansion of industry accompanied by improved transportation facilities. Because of the generally poorer quality of Soviet coal, however, its heat content is lower than that of United States coal.

In 1957, the German Federal Republic (western Germany) produced 273 million tons of coal. Commercial coal, much of it of coking quality, occurs in nearly a hundred seams in the Ruhr field, and reserves for the future are very large indeed. This coal has been a prime stimulant to the industrial development of continental western Europe. Production in the German Democratic Republic (eastern Germany) in that year reached 237 million tons, making a total of 510 million for Germany as a whole.

Great Britain too has built its industrial power on its coal, especially that of the midland region, about Manchester and Birmingham, which is of a high grade and of varied types. Production in 1957 was 250 million tons. Unfortunately, Britain's reserves of cheaply-produced coal are rapidly dwindling.

China has many coal fields scattered throughout its provinces, but deposits are often small or isolated and hence of limited value. However, most of the coal is bituminous and suitable for conversion into coke for the iron and steel industry. Manchuria, where some seams are unusually thick and also readily accessible, supplies a large share of the national output. Production has risen spectacularly in the last few years, reaching nearly 142 million tons in 1957, which makes China the world's fifth largest producer, after the Soviet Union, the United States, Germany, and Great Britain.

Production in other countries is generally small in proportion to the area or population, and small in any case in comparison with that of the big five.

MACHINERY IN THE MINES. With the aid of large and expensive new machinery, the average American coal miner produces over 11 tons daily, more than double his 1942 output. In fact, giant machinery has pushed pick and shovel mining into extinction, except in a few marginal mines in the Appalachian fields. The result is fewer miners, and higher wages. In 1948 there were jobs for 436,000 miners; the Bureau of Mines states that in 1958 an average of only 188,500 were employed.

Seventy-three per cent of American production is mined underground. Today's mine is an underground industrial plant, working on an assembly line principle. About 12 per cent of the underground coal is produced by a new machine, called the continuous miner, which eliminates the old

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A NEW MAP OF THE UNITED STATES, INCLUDING ALASKA AND HAWAII. Bi-polar conic conformal projection; scale, 1:5,000,000. 38½ x 25½ inches. 1959. Water features are shown in a strong blue, and the scheme of colors used for the hyposometric tints varies from a pale green for low land through the spectrum to purple for the highest land. Cities are classified according to population, and state names, state capitals, and the principal roads are emphasized. Prices: $1.00 (folded): $1.50 (rolled).

MAP OF THE AMERICAS. Scale, 1:12,500,000. 34 x 51 inches. Water features in blue, land elevations in greens and browns. Cities, classified according to population, and main railroads and roads are shown. Four insets show: Cities and Transport: Agricultural Land Use; Moisture Regions; and Natural Vegetation. Prices: $2.50 (folded); $3.00 (rolled); $3.50 (latex paper).

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cutting, drilling, blasting, and loading sequence. It simply chews into the seam and passes the bites to moving belts or shuttle cars to be taken to the surface. There is even in use now a remote-control continuous miner operated from about 50 feet away, and models which are operated from outside the mine are being developed.

Strip mining, which accounts for about one-fourth of United States production, employs huge draglines or stripping shovels to remove the overburden above the coal. When the seam is exposed, the coal is loaded into trucks by smaller shovels and prepared for market in the same way as underground coal. Strip mining recovers more than 90 per cent of the coal as compared with about 70 per cent in underground operations.

Auger mining is a third method used. It is a process of boring the coal horizontally out of hillsides or highwalls left by strip mining. Large augers have diameters up to 60 inches and penetrate a maximum of 200 feet into the highwall. Sites for auger mining are limited, but daily productivity averages about 25 tons per man, and this method permits recovery of up to 75 per cent of the coal.

Recently a continuous mining system, called punch mining, has been used for mining outcrops of coal or highwalls of strip mines after overburden becomes too deep for profitable removal. It consists of a machine equipped with four overlapping cutting heads which make holes about ten feet in width and three feet in height. The entire width of the coal seam can be mined in successive cuts.

The moving of coal to markets has always been a big problem. It is now being solved in a variety of ways. Much coal is reaching consumers by wire, in the form of electricity, and thus less surface transportation is required. Electric utility companies are also building plants nearer coal mines, and newer plants often have a conveyor belt system to transport the coal directly from the preparation plant to the thermal power plant. Another innovation is transporting coal by pipeline. Specially prepared coal is crushed and mixed with water to form "slurry" which moves through the pipeline. At the delivery point, the coal is separated from the water, then heated and dried for use.

FUTURE USES AND COMPETITION. Although we are concerned here with coal as a source of energy, a few of its other uses should be mentioned in passing. When coal is coked, one ton of bituminous produces about: 1,500 pounds of coke; 11,000 cubic feet of gas; 10 gallons of coal tar; 3.5 gallons of light oil; and 28 pounds of chemicals. Products,

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